COMP SCI / SFWR ENG 4O03 – Operations Research

Tutorial 1
January 15, 2010

Problem

The R. H. Lawn Products Co. has available 80 tons of nitrate and 50 tons of phosphate to use in producing its three types of fertilizer during the coming week. The mixture ratios and profit figures are given in the accompanying table. Determine how the current inventory should be used to maximize the profit.

	Tons / 1000 bags		Profit
	Nitrate	Phosphate	($/1000 bags)
Regular lawn	3	2	300
Super lawn	4	3	500
Garden	4	2	400

Solution

Let x_1, x_2 and x_3 be the amount of Regular lawn, Super lawn and Garden fertilizers produced respectively (in 1000 bags). The LP can be formulated as:

$$\max 300x_1 + 500x_2 + 400x_3$$
$$s.t. \quad 3x_1 + 4x_2 + 4x_3 \leq 80$$
$$2x_1 + 3x_2 + 2x_3 \leq 50$$
$$x_1, x_2, x_3 \geq 0$$

The standard form is:

$$\max 300x_1 + 500x_2 + 400x_3$$
$$s.t. \quad 3x_1 + 4x_2 + 4x_3 + s_1 = 80$$
$$2x_1 + 3x_2 + 2x_3 + s_2 = 50$$
$$x_1, x_2, x_3, s_1, s_2 \geq 0$$

The optimal solution is: $x_1 = 0, x_2 = 10, x_3 = 10$. So 40 tons of Nitrate and 30 tons of Phosphate should be used for Super lawn fertilizer, and 40 tons of Nitrate and 20 tons of Phosphate for Garden fertilizer. The maximum achievable profit is $9000.